UTRECHT JOURNAL OF
INTERNATIONAL AND EUROPEAN LAW

International Climate Law: Principles and Obligations for Adaptation

RESEARCH ARTICLE

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ubiquity press

ABSTRACT

The article examines the evolution of adaptation principles and state obligations under international climate law focusing on the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement. In particular, it explores core principles, such as precaution and common but differentiated responsibilities and respective capacities, and how these guide States' obligations in addressing climate change impacts. In the context of implementation challenges, including financial gaps and disagreements among States, the article further analyses how these principles influence decision-making, set standards for conduct, and promote accountability for climate change adaptation. It argues that the normative content of relevant principles and obligations on climate change adaptation have not been clearly articulated in treaty provisions or Conference of the Parties (COP) decisions. The article therefore explores core and emerging obligations relevant to adaptation, such as the development and implementation of national adaptation plans (NAPs), submission of adaptation communications, promotion of climate-resilient development, support for vulnerable countries, and enhancing adaptive capacity. It emphasises the importance of principles such as common but differentiated responsibilities and respective capabilities (CBDRCCR) and international cooperation and support as foundational for the international framework on climate change adaptation. The article analyses these principles and obligations toward the further development of the legal and normative framework for responding effectively to the challenges posed by the adverse effects of climate change. Based on the findings, this article argues that the principles enshrined in international climate law, especially the CBDRRC and international cooperation and assistance should form the foundational legal framework for international climate adaptation action.

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KEYWORDS:
Adaptive capacity and resilience; Global Goal on Adaptation; international framework on climate adaptation; principles of climate law; obligations of States for climate adaptation

TO CITE THIS ARTICLE:
Michael Addaney, 'International Climate Law: Principles and Obligations for Adaptation' (2025) 40(1) *Utrecht Journal of International and European Law* pp. 23–42. DOI: https://doi.org/10.5334/ujiel.653

1 INTRODUCTION

The average global temperature has increased by about 1.1°C and sea level by 20 cm since the late 19th century.[1] In 2023, the temperature was recorded as the warmest ever, with 1.45 ± 0.12°C higher than the pre-industrial average.[2] The weather is changing significantly due to the rising temperatures. The world's oceans are getting more acidic due to a concurrent increase in carbon emissions.[3] There is already evidence of the physical effects of climate change, such as rising sea levels, acidification of the seas, melting of glaciers and sea ice, warming of the troposphere (the lower part of the atmosphere), and a slowdown in agricultural and food production.[4] Scientists are unable to agree on a threshold or level of human interference with the climate system where climate change moves from safe to dangerous.[5] Even with a 2°C increase in temperature, some disruptions and irreversible losses of natural habitats and resources are to be expected.[6] The physical impacts of climate change will have far-reaching effects on human societies, including public health, economic growth, agriculture and food production, peace and security, and migration.[7]

Extreme temperatures, heat waves, and the spread of some diseases, including dengue fever and malaria, in areas where they were not previously common - and where the population may have a lower level of immunity and adaptive capacity – all have an impact on human health.[8] In certain parts of the world, there are more frequent and severe droughts and floods in addition to some extreme weather events (such as heatwaves, tornadoes, cyclones, storms, and wildfires). The impacts of climate change raise novel issues in protection, to which international adaptation action seeks to offer at least some partial solutions.[9] However, under international law, States have some positive obligations which apply to the impacts of climate change within their jurisdiction. More broadly, States' obligations include the creation of favourable conditions for human development,[10] adoption of an effective disaster risks management system,[11] and safeguarding the environment either independently,[12] and when necessary, through international cooperation.[13]

Over the last thirty years, there has been a recognition of climate change's urgency as a global issue.[14] As a result, international law is increasingly becoming relevant in setting legal and policy agendas through framework laws and guidelines toward developing national laws addressing this challenge. The international framework on climate change includes the United Nations Framework Convention on Climate Change (UNFCCC),[15] and the Paris Agreement,[16] as well as a host of supporting documents[17] and initiatives taken under the auspices of the UNFCCC. International climate change law in general, and adaptation in particular, is predominantly informed by scientific evidence and, thus, foregrounds the measurable impacts of climate change and socio-technical solutions.[18] Furthermore, the emerging body of international climate change law uses equity-based principles such as common but differentiated responsibilities and respective capacities (CBDRCCR), common concern of humankind, sustainable development, international cooperation, and gender sensitivity as well as promoting the use of technologies in addressing the impacts of climate change.[19] It also actively recognises the need for developed countries to support the adaptation efforts of vulnerable developing countries and populations because of their unique vulnerabilities to climate change impacts.[20]

Due to the dire nature of the consequences of climate change, adaptation, rather than mitigation, has become more urgent for the majority of the States and populations in developing regions. This increasing emphasis on adaptation has come with little clarity about the legal meaning and implications of this concept. Treaty provisions and COP decisions have so far failed to articulate the normative content of the relevant texts on adaptation including the applicable principles and States' obligations, thus raising questions as to what precisely legal provisions on adaptation seek to achieve. In fact, most provisions on climate change adaptation are moralistic and aspirational and impose few, if any, obligations on States.[21] This article analyses the core principles and associated States' obligations relating to adaptation under international climate change law. In achieving this, the article traces the historical development of climate change adaptation under the UNFCCC, focusing particularly on the Bali Plan of Action, the Cancun Adaptation Framework and the Paris Agreement. It then provides an overview of States' obligations relating to climate change adaptation under international climate law and other areas of international law such as the development and implementation of national adaptation plans (NAPs), submission of adaptation communications, promotion of climate-resilient development, support for vulnerable countries and populations, and enhancing adaptive capacity. The core principles of the UNFCCC regime discussed are: precaution, common but differentiated responsibilities and respective capabilities, intergenerational and intra-generational equity, no-harm, polluter-pays, and international cooperation and support. Based on the findings, this article argues that the principles enshrined in international climate law, especially the CBDRRC and international cooperation and assistance should form the foundational legal framework for international climate adaptation action. Following this introduction, section II briefly sets out the conceptual development of climate change adaptation law. Section III discusses the core principles and States' commitments relating to climate change adaptation under international climate change law. Section IV concludes the discussion.

2 CLIMATE CHANGE ADAPTATION AS AN EVOLVING CONCEPT IN INTERNATIONAL CLIMATE CHANGE LAW

2.1 FOUNDATION OF THE INTERNATIONAL LAW ON CLIMATE CHANGE, FROM MITIGATION TO ADAPTATION

International climate change law provides principles, normative standards and policy guidelines on climate mitigation and adaptation action, not only through the texts of the UNFCCC, the Kyoto Protocol, and the Paris Agreement but also in the scientific reports that inform their development. Thus, the principles, objectives and obligations provided in the international mechanisms addressing climate change are largely informed by the technical and scientific evidence that detail the physical and economic impacts of climate change.[22] The scientific reports and data on climate change are provided mainly by the Intergovernmental Panel on Climate Change (IPCC), through its assessment reports and other special reports on particular aspects of climate change and how to address it. After the publication of its first assessment report in 1990, the IPCC published six additional reports with the latest released in 2022. The production of IPCC reports shows little disciplinary diversity, as experts from economics and the natural sciences are dominant, with a general lack of experts from the humanities and social sciences.[23] The technical approach to addressing climate change as a global environmental challenge has influenced the prioritisation of mitigation over adaptation in the international cooperation on climate change. Climate change mitigation presents a technical solution to a technical problem as it recognises the problem of climate change as the level of concentration of greenhouse gases (GHGs) in the atmosphere and thus, the solution lies in reducing GHGs emissions.

Thus, understanding climate change largely as a technical problem determines how international law seeks to address it.[24] Climate change should, however, not be minimised to a technical or physical problem as it transcends the measurement of GHG concentrations in the atmosphere, and actions to deal with climate change should also go beyond reducing GHG emissions. Climate change is not just a technical or physical issue, but also a social, cultural and political crisis[25] as people in varying contexts experience the effects of climate change differently. Scientific assessments that emphasise the technical and physical impacts of climate change shape the international climate change regime, which thus, sustains a certain approach to climate change and neglects other ways of understanding and thus, addressing the problem. By drawing so heavily on scientific information, the international legal framework on climate change adopts and constructs a strong technocratic approach that, in turn, shapes the discourses on international climate change action.[26]

Climate change adaptation action is multifaceted as it depends on the sector and context through taking existing vulnerabilities into account. The IPCC's first assessment report responded only to mitigation, without any mention of adaptation. Before the third assessment report was issued in 2001, it had been broadly agreed that climate change might not be substantially reduced in a realistic timeframe, and adaptation was covered in a distinct volume.[27] Adaptation has since received increased attention, as it has now become evident that mitigation alone cannot address climate change as the negative impacts of climate change are increasing in intensity and frequency. The UNFCCC, the Kyoto Protocol, and the Paris Agreement officially cover both mitigation and adaptation.[28] However, the UNFCCC ultimately seeks to attain 'stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system';[29] or simply, mitigation. The Kyoto Protocol was almost exclusively geared towards mitigation.

The Paris Agreement is inclusive in terms of its objectives, including mitigation (keeping the global temperature increase to a 2° Celsius maximum), adaptation (fostering climate resilience), as well as finance for mitigation and adaptation.[30] Adaptation, thus, received much more space in the Paris Agreement than in the previous legal mechanisms on climate change. Nevertheless, in practice, the focus is still largely on mitigation. Despite the increasing attention on adaptation action, the nature and extent of such actions in a given context will ultimately be determined by mitigation. The more GHGs are emitted into the atmosphere, the more disastrous will be climate-induced disasters and other extreme weather events; making adaptation action less effective in many regional and national contexts. Such scenarios will unquestionably raise the costs of adaptation and further reduce the effectiveness of adaptation measures.

Consequently, climate change adaptation action should be buttressed by an effective mitigation action that focuses on the reduction of GHGs, thus minimising the intensity and occurrence of the adverse consequences of climate change. Accordingly, both adaptation and mitigation responses are equally significant in addressing climate change impacts.[31] The NDCs being submitted by States as part of their commitments under the Paris Agreement, however, concentrate, to a great extent, on the reduction of GHGs. Mitigation is still easier to measure, identify, and place into a legal framework than adaptation, which can mean many different things under different contexts and sectors. The scientific bases that inform the international law on climate change are important in understanding the principles and norms of climate adaptation law. Science, principally the natural sciences and economics not only shapes dominant

mitigation measures but also informs adaptation strategies.

This section has set out briefly the evolution and objective of the international legal framework on climate change. The next section explores the meaning of adaptation under international climate law.

2.2 THE MEANING OF CLIMATE CHANGE ADAPTATION UNDER INTERNATIONAL CLIMATE LAW

Climate change is already happening, and populations across the world, in both developed and developing countries, are being affected by its adverse impacts.[32] Despite the relevance of laws and policies in mitigating climate change through the enhancement of sinks and reductions of sources of GHGs, this has proven inadequate.[33] The IPCC in its Fifth and Sixth Assessment Reports noted that even the most stringent mitigation efforts cannot avoid the impacts of climate change which makes adaptation unavoidable.[34] In this regard, Craig observes that:

> While developing and implementing successful mitigation strategies clearly remains critical in the quest to avoid worst case climate change scenarios, we have passed the point where mitigation efforts alone can deal with the problems that climate change is creating. Because of 'committed' warming – climate change that will occur regardless of the world's success in implementing mitigation measures, as a result of the already accumulated GHGs in the atmosphere – what happens to socio-ecological systems over the next decades, and most likely over the next few centuries, will largely be beyond human control.[35]

There is therefore a need to adopt strict measures for the protection of populations, cultures, economic production, infrastructure and ecosystems from the adverse effects of climate change. Consequently, the development and implementation of adaptation action and the related laws and policies are political and deeply embedded in national development policies and strategies.[36]

The IPCC explains climate change adaptation as 'adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.'[37] To be more specific, Neil Adger and others define climate change adaptation as 'adjusting to risks either in reaction or in anticipation of changes arising from changing weather and climate'.[38] Adaptation is also seen as the process of directing society away from dangerous thresholds or at a minimum, limiting possible fatalities and damage resulting from climate risks and extreme weather events.[39] These various descriptions of adaptation enrich the legal analysis of climate change adaptation action by contributing varied viewpoints and approaches to addressing the negative impacts of climate change.[40]

The IPCC, in its Fifth Assessment Report, developed an appropriate scientific basis for understanding the harmonised entry points for addressing the adverse effects of climate change.[41] The IPCC's framework categorises the effects of climate change based on three elements: hazard, exposure and vulnerability.[42] Hazard is conceptualised as the potential occurrence of a physical event at a given location, while exposure refers to the presence of people or properties in locations and settings where the event may occur.[43] However, vulnerability is the tendency of exposed people or things to be adversely and severely affected by such extreme events. Liverman compares vulnerability to terms such as 'resilience', 'marginality', 'susceptibility', 'adaptability', and 'risk'.[44] In the context of climate change, vulnerability is theorised as the extent of exposure and ineptness of geographical, ecological, biological and socio-economic systems to deal with the negative impacts of climate change.[45] The IPCC argues that instead of concentrating on separate actions to adjust to specific expected climate change risks and exposures, it could be more efficient and cost-effective for countries to situate their legal and governance mechanisms on resilience building.[46]

There are two approaches to climate change adaptation – adaptation as a matter of protection or as a matter of remediation.[47] Protection-based adaptation is described as a challenge that States need to address within their territory, such as human rights protection and promoting sustainable development. On the other hand, remedial-based adaptation is conceptualised as addressing the adverse effects of climate change from the perspective of a wrongful act. Thus, the failure of States to prevent excessive GHG emissions attracts a duty of the responsible States and the obligation to pay adequate reparation to the affected States.[48] However, protection-based adaptation has largely dominated the discourse on adaptation within the UNFCCC regime. This article adopts the protection approach to adaptation and explores it further in the subsequent sections. Under international law, States have certain obligations that are applicable in the context of responding to the adverse impacts of climate change within their jurisdiction. Under international human rights law, which is increasingly being connected to climate change and climate action, States must adopt all reasonable measures based on their capacity for the protection and realisation of the rights of everyone under their jurisdiction.[49]

More broadly, they are to create the necessary conditions for the promotion of human development,[50] effective management of disaster risks,[51] and

environmental protection.[52] States are encouraged to fulfill these responsibilities individually, and through international cooperation when necessary. There is a general consensus that the adverse impacts of climate change raise new protection challenges to which international climate law seeks, at a minimum, to offer some responses.[53] Climate change adaptation is usually integrated into diverse laws, policies, programs and projects that are traditionally done through development and disaster risk reduction policies.[54] This phenomenon makes it difficult to isolate adaptation action within these broader laws, policies, programs and projects and, consequently, making adaptation to climate change much more abstract as compared to mitigation efforts.

Developing countries, which receive special attention in adaptation discourse, experience diverse but significant challenges due to, *inter alia*, climate change impacts which continue to threaten critical infrastructure systems, biodiversity, and residents' livelihoods.[55] It is therefore essential to understand the diverse adaptation measures adopted by developing and least developed nations in different geographic locations in order to examine the principles and States' obligations under international climate law. Due to the increased intensity and frequency of the impacts of climate change, it has become increasingly necessary to develop a framework for adaptation laws and policies. Climate change adaptation offers lawmakers a difficult balancing act and could result in conflicts due to the mix of scientific uncertainty, politics and changes in economic, social and socio-ecological well-being.[56] These developments have significantly influenced the legal evolution of international climate law generally and adaptation action more specifically, particularly its emerging principles and States' obligations, as will be demonstrated in the following section.

3 INTERNATIONAL COOPERATION ON CLIMATE CHANGE ADAPTATION: AN ANALYSIS OF THE FOUNDATIONAL PRINCIPLES WITH REFLECTIONS ON STATES' OBLIGATIONS

The section discusses the obligations of States relating to climate change under international climate law and the corresponding principles for enhancing adaptation action. It begins by briefly exploring the core obligations of States, both developed and developing countries, to undertake climate adaptation action independently or through cooperation. The principles of Common but Differentiated Responsibilities and Respective Capacities, No-Harm, Polluter-Pays, Precaution, Inter- and Intra-generational Equity, and International Cooperation and Support, which are fundamental in international law are discussed. While assessing the legal implications of the principles of international climate law relating to adaptation, their legal status is clarified and their applicability is examined; including with a view to their application in subsequent practice. International climate law principles, just as international environmental law principles, serve various functions. First, these principles provide a framework for States to follow in their efforts to address climate change as the principles inform decision-making processes at the international, regional and national levels. Further, the principles establish standards for State conduct, providing a basis for assessing compliance as well as promoting accountability among States and other actors for their actions related to climate change. Accordingly, these principles are more than aspirations but can be relied upon as sources of rights and obligations and serve as interpretation guides for duties in other instruments.

3.1 PRECAUTION

The vast scale and intensity of the impacts of climate change are largely imaginary and uncertain in nature.[57] The devastating and uncertain nature of these impacts has become one of the primary limitations to the collective efforts of national governments in the allocation and investment of resources for the implementation of adaptation action. There is no hard and fast rule concerning threshold levels to be crossed in each ecosystem. However, a degree of confidence can be articulated based on precaution to justify the global action on adaptation.[58] The precautionary principle is premised on the notion that it is better to err on the side of caution and avert environmental harm than it is to try and address irremediable harm retroactively. Under this principle, the lack of full scientific knowledge or certainty is not grounds for avoiding appropriate measures to avert environmental harm in situations where there are threats of serious or irreparable damage.[59] From a legal point of view, the implication of the principle is that scientific uncertainty works against the prospective polluter instead of in their favour once a prima facie case has been established, contrary to what used to be the case in the past.[60] It therefore offers a legal foundation that reduces the threshold under which states are required to take action to prevent environmental damage even when faced with uncertainty.[61] Another important aspect of the precautionary principle is its contribution to the development of a distinct standard of proof in cases relating to the environment, where the liability regarding a prospective project's absence of the harmful consequence falls on those wanting to modify the status quo.[62] This essentially leads to a reversal in the burden of proof in environment-related cases as the evidentiary burden commonly lies with the one resisting change.[63] Consequently, the burden of proof lies with the State or entity proposing an action that poses an identifiable

risk of serious or potentially irreparable harm to the environment.[64]

The 'precautionary approach'[65] is one of the fundamental principles of the UNFCCC. Article 3(3) provides that:

> The Parties should take precautionary measures to anticipate, prevent or minimise the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures, taking into account that policies and measures to deal with climate change should be cost-effective, so as to ensure global benefits at the lowest possible cost.[66]

The precautionary principle provided in Article 3(3) is not only applicable to mitigation but also applies to adaptation action.[67] In the context of adaptation, the principle of precaution implies that States undertake measures 'according to their capabilities',[68] even if there is insufficient evidence concerning potential harm associated with climate change. Full scientific certainty is not required in such situations since the threshold levels are reduced significantly to rationalise climate change adaptation action. Therefore, the lack of scientific certainty concerning the nature and scale of impacts of climate change cannot be grounds for postponing adaptation actions. Due to the rapid nature and uncertainties associated with variations related to climate change, the precautionary principle is gradually being used in development and climate-related policymaking, predominantly in the areas of extreme heat, drought, flooding, sea level rise, and associated coastal erosion concerns in certain national jurisdictions. The principle of precaution is, thus, an essential tool that can be useful in global action on climate change adaptation.

3.2 COMMON BUT DIFFERENTIATED RESPONSIBILITIES AND RESPECTIVE CAPACITIES

Explicitly stated in Article 3(1) of the UNFCCC as basis for the international cooperation on climate change, the CBDRRC principle provides that:

> The Parties should protect the climate system for the benefit of present and future generations of human kind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof.[69]

The principle underscores the Parties' varying responsibilities and abilities, connecting CBDRRC to equity while also emphasising a clear divide between developed and developing countries. Since the beginning of the international negotiations on climate change, the CBDRRC has impacted how the international community addresses the issue.[70] This principle further reflects the varied historical, social, economic, and political circumstances in developed and developing countries and forms an important element of the international climate change regime.[71] It further identifies differences in the historical contributions of developed and developing countries to global environmental challenges, as well as the differences in their individual financial and technical capacity to address these harms.[72]

The principle consequently acknowledges climate change as a collective problem that requires the concerted efforts of all countries to address and that the capabilities of individual countries should be a determining factor in guiding the extent of their efforts. Thus, it concurrently addresses inequalities. The CBDRRC principle duly takes into account equity, fairness,[73] and cooperation,[74] giving room for negotiations between developed and developing countries. Therefore, it is a practical mechanism which helps in implementing equity across the 'north-south' divide.[75] Considering the high cost related to tackling climate change and the extremely imbalanced distribution of the benefits and cost of doing so, the central role of the principle in ensuring differential treatment between developing and developed countries in the international climate change regime is not surprising.[76]

The debate surrounding the legal meaning and application of the CBDRRC principle is the most prominent question of principles preoccupying international climate change policies and negotiations.[77] The preamble of the Kyoto Protocol recognises this principle and is also differently articulated in the Paris Agreement.[78] The Kyoto Protocol, for example, is explicitly based on the CBDRRC principle as it contains a burden-sharing mechanism that paves the way for country-specific obligations in the international cooperation on climate change.[79] The preamble of the UNFCCC also reflects this by stating that the 'earth's climate and its adverse effects are a common concern of humankind' (emphasis added). 'Common responsibilities' means that all parties to the international convention and its related instruments adopted should participate in the response to addressing the climate change issue. Arguably, the way it is expressed does not convey any hard obligations. However, its mere expression gives significance to climate change as a common problem and in that way, it reconfirms the principle of CBDRRC.[80] The principle then requires all States Parties to take part in international actions directed at addressing environmental challenges. In the UNFCCC, obligations in

Article 4(1) are subject to 'specific national and regional development priorities, objectives and circumstances'.[81]

Another important remark is that the CBDRRC principle is the basis for the burden-sharing character under the climate regime. In this regard, its first component, which is a common responsibility, cannot be separated from the second. That is to say, if especially the developing countries call for special treatment, although they have not contributed equally to climate change, they should accept dealing with it as a common concern. The lack of an explicit definition of the principle and the word 'responsibility' in the UNFCCC regime may provide a leeway for non-willing States to argue that the word 'responsibility' unquestionably does not imply the legal penalties of an internationally wrongful act. However, treaty obligations are meant to be performed in 'good faith'[82] and therefore under general international law, the principle should be a core responsibility of all States.

The notion of differentiated responsibilities derives both from the differing contributions of States to climate change and their differing capacities to take remedial measures.[83] The term 'differentiated' signals the need for differentiation between parties, but the principle explicitly indicates only one basis for such differentiation which is 'respective capabilities'.[84] The first justification is that developed countries have benefited from and, by implication, harmed the environment more than developing countries.[85] This is in part, due to the varied accountability of States to climate change and the differences in States' individual financial and technical resources in addressing the climate crisis. In other words, the special developmental needs of developing countries, that are highly vulnerable to the negative impacts of climate change, are also grounds for differentiation.

Developing States parties must prioritise sustainable development to address or moderate the adverse effects of climate change by building resilience and implementing effective adaptation measures.[86] The need for industrial countries to fulfil their commitments also includes addressing climate change through mitigation efforts.[87] In the developing world, human development prioritises needs in a hierarchical manner, placing the environment as a lower priority. Even within the list of priorities for climate change, adaptation is seen as urgently important. Utilising the CBDRRC principle in this situation underscores that industrialised countries have the main responsibility for mitigating climate change while developing countries primarily focus on sustainable development and adapting to the adverse effects of climate change.[88] In line with the CBDRRC principle, developed and developing countries are expected to work together, considering their own capacities, to achieve the main goal of international climate change law. Hence, while developed countries should help developing and least developed countries, which are most affected by climate change, with financial support for adaptation and technology transfer, developing countries such as China and Brazil should increasingly take on mitigation responsibilities in efforts to meet the global mitigation goal.[89]

Under the Paris Agreement, developed State parties are obliged to provide financing to developing countries and it acknowledges that developing countries need support to successfully implement the Agreement.[90] Nevertheless, the Paris Agreement departs from the UNFCCC as it unequivocally allows 'other countries' to voluntarily provide climate financing and, as a result, softens the divide between developed and developing countries under international climate change law.[91] Despite the contestations, the concept of equity in climate law is central to the emerging law on adaptation under the UNFCCC regime. Under the existing international climate change regime, there is an omission of concrete differentiation in the provisions that form the core obligations under the Paris Agreement. As an alternative, the goal of the Paris Agreement to keep global temperature increases 'well below' 2°C is envisioned to be accomplished through nationally determined contributions (NDCs) that all countries, including both developed and developing, are required to communicate to the COP secretariat on a regular basis.[92] The differentiation in the Paris Agreement, through this innovation, has amended the CBDRRC principle and, thus, can be construed as facilitating the 'race to the top' requirements.

The CBDRRC has influenced various international climate change adaptation programmes between developed countries and developing countries. For instance, the Pacific Ecosystem-based Adaptation to Climate Change (PEBACC) which is a five-year project funded by the Green Climate Fund (GCF) explores and promotes ecosystem-based options for adapting to climate change in small island developing countries such as Vanuatu, Fiji, and the Solomon Islands from 2024 to 2030.[93] The project has a total value of 8,896,275 USD in GCF financing in addition to an additional 1,046,000 USD in co-financing which includes grants and in-kind contributions.[94] Previously, the Pacific Adaptation to Climate Change (PACC) Programme implemented by the Secretariat of the Pacific Regional Environment Programme (SPREP) from 2009 to 2019 prioritised and promoted adaptation in coastal zone management, water resource management, and food security in 14 Pacific island countries.[95] The ultimate goal of the programme was to enhance the resilience of Pacific island communities to the impacts of climate change by fostering sustainable development and poverty reduction as well as regional cooperation and coordination on climate change adaptation efforts.[96] The PACC Programme was supported by the Global Environment Facility (GEF), the governments of Australia and Germany, and other donors. Thus, the GCF with contributions from developed

countries such as Germany, Japan, the United States, and the United Kingdom is supporting various adaptation projects in developing and least-developed countries under the framework of international cooperation on climate change. The CBDRRC principle and its contribution to the emerging law on climate change adaptation is expected to evolve in a more contextual direction. The single hindrance to this development is when developing and least developed countries thwart the process due to fear of losing the influence that the CBDRRC principle has had on past negotiations.

Despite its relevance, the CBDRRC principle creates tensions with other environmental law principles. For instance, the CBDRRC's emphasis on differentiated responsibilities based on historical emissions and capabilities may conflict with principles of equity and justice, particularly for developing countries.[97] Similarly, the CBDRRC's focus on respective capabilities might lead to differing interpretations of the precautionary principle and potentially undermine its application.[98] Furthermore, the emphasis on national circumstances and capabilities may conflict with the principles of sovereignty and cooperation, especially in international environmental governance.[99] A key focus of the CBDRRC principle on current capabilities and responsibilities may overlook the needs and rights of future generations and potentially conflict with the principle of intergenerational equity.[100] From a Global South perspective, the CBDRRC's approach to differentiated responsibilities may open potential pathways for the operationalization of the polluter pays principle which holds that those responsible for pollution should bear the costs of mitigation and adaptation. Critical scholars from the Global South however argue that the CBDRRC's approach to differentiated responsibilities may also be seen as inconsistent with the polluter pays principle as it demands those responsible for colossal GHGs emissions to bear the cost of mitigation and adaptation.[101] These tensions highlight the complexities and challenges of implementing CBDRRC in the context of international environmental law.

3.3 INTER- AND INTRA-GENERATIONAL EQUITY

There is a general recognition that the prudent use and consumption of natural resources should consider the interests of both present and future generations. This implies that when protecting the global environment and natural resources, there should be a consideration of the welfare and developmental needs of the future generation or shared inheritance.[102] This concept exemplifies the time-related aspect of sustainable development, suggesting that choices made now will greatly affect future generations.[103] It originates from a pact between present and future generations, where the current generation must pass down the environment and natural resources they received from past generations in a sustainable way through a 'fiduciary duty' grounded in 'planetary trust.'[104] Future generations should have access to the environment and natural resources left for them, without being restricted from benefiting from their own development.[105] The principle of intergenerational equity requires the development and implementation of specific duties to meet the needs of future generations, which include 'conservation of options', 'conservation of quality' and 'conservation of access'.[106]

Accordingly, it is necessary for States to reconsider their development pathways and adopt adaptation measures to ensure that development is in line with long-term climatic changes. The Qinghai-Tibet railroad and the Confederation Bridge connecting Prince Edward Island with mainland Canada are both examples of projects that considered the needs of future generations. During the century-long duration of the project, the construction of the Confederation Bridge added an additional meter for potential sea level rises. Similarly, the Qinghai-Tibet railway stretches approximately 500 kilometres over permafrost at an elevation of 4000 meters. The design and actual construction integrated cooling and insulation systems to minimise heat absorption by the permafrost in consideration of sea level rise during the project's lifetime.[107] These two development projects provide a good example of how incorporating future needs into project design can lessen the burden on future generations to redesign these structures.

Similar to the CBDRRC, intra-generational equity requires that in sharing the costs of adaptation and mitigation, the uneven contributions of countries to the climate crisis and their capabilities in addressing them should be considered.[108] The grounds for exempting developing states from the burden of mitigation and adaptation action is their unequal contribution to climate change. Thus, the same obligation should be placed on developing countries in their dealings with vulnerable populations and individuals such as indigenous peoples, forest-dependent peoples, urban and rural poor, children, women and the aged who are underprivileged and less capable of adapting to the negative impacts of climate change. These populations are largely marginalised by society and thus, there is an equal moral claim on States to offer them special assistance in their responses to climate change adaptation.[109] This principle has, however, been criticised by scholars such as Stone who argues that the privilege accorded developing states on the basis of their special circumstances fails since 'ordinarily, the people who are in need of something are likely to bear the cost'.[110] He also argues that relying on the wealth and technological capacity of developed nations as the core basis for differentiation is ethically indefensible as it holds current generations in industrialised States responsible for the actions of their ancestors.[111] This argument by Stone is problematic in that current generations could be held liable for the actions of their ancestors since they

are still enjoying the benefits of such developments. Also, the assertion by Stone that the most at-risk populations should be made to pay more on the basis of need is unacceptable and morally wrong.

3.4 NO-HARM AND POLLUTER-PAYS

In a disagreement over a smelter in Trail, located in British Columbia, Canada near the US border, the arbitral tribunal of 1941 recognised the principle of no-harm for the first time. The smelter's extensive release of fumes was causing significant environmental damage to neighbouring communities, especially those in the US across the border. After diplomatic efforts failed to resolve the dispute, the US initiated arbitration against Canada. The arbitral tribunal decided against Canada for the following reasons in its ultimate ruling:

> Under the principle of international law, no State has the right to use or permit the use of its territory in such manner as to cause injury by fumes in or to the territory of another or properties or States therein, when the case is of serious consequence and the injury is established by clear and convincing evidence.[112]

The principle has since been affirmed by international courts and tribunals,[113] and has been included in several international documents including the 1972 Stockholm Declaration on the Human Environment. The Stockholm Declaration in Principle 21 states that:

> States have, in accordance with the Charter of the United Nations and principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States through the limits of national jurisdiction.[114]

The UNFCCC emphasises the 'pertinent provisions' of the Rio Declaration on Environment and Development in its preamble, and it also reinforces the principle of non-harm.[115] Some scholars, such as Philippe Sands and Jacqueline Peel, argue that the principle of no harm is crucial in international environmental law.[116] The ICJ has recognised the principle of no-harm as customary international law in an advisory opinion on the legality of the threat or use of nuclear weapons.[117] Benoit Mayer believes States that harm the environment, either directly or by allowing excessive greenhouse gas emissions, violate the principles of equal sovereignty and no harm.[118] Climate change is recognised as a serious environmental threat that could lead to the destruction of entire regions in certain countries and significantly hinder the progress and enjoyment of human rights for people in all nations.[119]

Climate change is undeniably different from transboundary pollution in significant respects. For example, in the classic Trail Smelter case, activities within one State's territory discharged environmentally harmful substances which caused direct damage in another State's territory, unlike climate change.[120] In this case, the damage was directly caused by substances which crossed an international border and the associated harm was also confined to a relatively small area within the other State. By contrast, the excessive emissions of GHGs have an effect on the global climate system instead of a relatively small border area or any specific State or region.[121] Although the impacts of climate change affect several places across the world, none of these impacts is the direct result of GHG emissions from a particular State or at a given time. Instead, climate change is a consequence of the cumulative effect of GHG emissions from multiple States and over several decades, and thus, causes significant environmental impacts across the world through the gradual alteration of the Earth's atmosphere.[122] The hostile consequences of climate change accordingly affect every State's territories including the global commons.

The relevance of the no-harm principle in the context of adaptation to the negative impacts of climate change is increasingly being acknowledged. However, there have been arguments for its exclusion in the international action on climate change. Alexander Zahar contends that the no-harm principle would not necessarily be applicable to scenarios where damages are as a result of progressive accumulation of harmful substances in the atmosphere as the no-harm principle is recognised generally when damages are the direct result of pollutants crossing international borders.[123] Nevertheless, this difference appears not to be of any substance in relation to the application of the no-harm principle in the context of international climate change adaptation action. Also, in the ICJ Advisory Opinion on the application of the no-harm principle to environmental damage similar to the cumulative nature of climate change, the Court relied on the diffuse harm of such activities on the international environment through consideration of risks of a nuclear winter or interference with the Earth's electromagnetic fields, without distinguishing between the direct and cumulative damages.[124]

The two dissenting opinions suggested that a distinction between direct and cumulative damages should be made, and thus, a different treatment should apply to damages affecting the international environment. They however did not exclude the application of the no-harm principle to cumulative damage, but instead argued for a stricter application of the principle in such cases. Other arguments such as the multiple sources of GHGs

emissions have been used to defend the exclusion of the no-harm principle in the context of climate change.[125] Although climate change is far more complicated than the use of nuclear weapons during war, or classic bilateral transboundary disputes relating to environmental harms, only a few States such as the United States, Russia, China and the United Kingdom possess nuclear weapons, just as a few States such as the United States, China, and the European Union are accountable for more than half of global GHGs emissions contributing to global climate change.[126] Consequently, the multifaceted nature of climate change is not a sufficient ground for the exclusion of the no-harm principle.

With a similar framing, the polluter-pays principle requires those responsible for environmental damage to face repercussions. This suggests that holding the State responsible for fixing the harmful effects should deter them from further harming the environment. The credibility of the principle as State practice was undermined after an arbitral tribunal declined to recognise it as part of general international law.[127] It has been argued that State practice does not indicate that the polluter should bear all the costs of pollution, especially in inter-state relations.[128] Mayer believes that the notion of the State that causes harm being responsible for compensating the victim is a crucial ethical and legal concept.[129] He also concurs with Philippe Sands and Jacqueline Peel's assertion that the responsible party should not always be solely responsible for covering all expenses, but rather should incur costs to prevent further pollution.[130] Some developing countries are pushing for the recognition of this principle at the international level to ensure that those responsible for significant greenhouse gas emissions are held responsible for mitigating the impacts of climate change. This principle draws from the same underlying principles as no-harm and CBDRRC, in addition to considerations of justice and fairness.[131] When assigning responsibilities for domestic and national climate change adaptation efforts, the well-established legal principle of the polluter-pays concept should be taken into account.

3.5 INTERNATIONAL COOPERATION AND SUPPORT

Cooperation is undeniably indispensable for addressing significant environmental issues affecting the entire planet such as climate change. The Stockholm Declaration on Human Environment underscores that 'cooperation through multilateral or bilateral arrangements or other appropriate means is essential to effectively control, prevent, reduce and eliminate adverse environmental effects.'[132] The Rio Declaration on Environment and Development stresses the significance of collaboration between individuals and states in fulfilment of the principles embodied in this declaration.[133] Because climate change is caused by the cumulation of GHG emissions from human activities in multiple States, it is not possible for any one State to effectively tackle the issue by itself. Due to this, the principle of cooperation is essential for international action addressing the adverse impacts of climate change. Cognisant of this, the UNFCCC, in its preamble recognises that:

> The global nature of climate change calls for the widest possible cooperation by all countries and their participation in an effective and appropriate international response, in accordance with their common but differentiated responsibilities and respective capacities and their social and economic conditions.[134]

States engaging in free riding may be seen as not aligning with the principle of cooperation, which requires States to participate in honest negotiations to minimise the harmful impacts of climate change.[135] However, unless a State openly refuses international collaboration on climate change, it might be challenging to hold them responsible for violating the norm.[136] This principle may be seen as conflicting with the US's decision to pull out of the Paris Agreement and Canada's withdrawal from the Kyoto Protocol. These decisions may be interpreted as forms of non-compliance.

The Copenhagen Accord encourages States to collaborate internationally to address the negative impacts of climate change.[137] The 2030 Agenda for Sustainable Development requires the most extensive international collaboration to tackle adaptation to the negative impacts of climate change.[138] Concerns related to adapting to climate change are not as challenging as those in mitigating climate change, which requires collaboration among States through international climate change law. This essentially recognises that all countries, particularly developed ones, have a duty to help developing countries with their adaptation efforts due to their failure to prevent the release of excessive GHGs within their jurisdictions. International cooperation on climate change requires information sharing and best practices as mandated by the UNFCCC that 'all States should provide communication on the measures being undertaken toward adaptation to the adverse effects of climate'[139] and to 'cooperate in preparing for adaptation to the impacts of climate change'.[140] In addition, States Parties are encouraged by the Marrakesh Accords 'to exchange information on the experiences relating to the adverse effects of climate change and on measures to meet their needs arising from these adverse effects'.[141]

Additionally, the Cancun Agreements strongly encouraged an 'enhanced action on adaptation, including through international cooperation'.[142] Therefore, the Adaptation Committee was tasked with the duty of 'strengthening, consolidating and enhancing the sharing of relevant information, knowledge, experience

and good practices',[143] and 'providing information and recommendations, drawing on adaptation good practices, for consideration by the Conference of Parties'.[144] The Paris Agreement in Article 7(6) calls on parties to enhance support for adaptation in developing countries, especially those that are most vulnerable to the effects of climate change, and to submit periodic reports on adaptation priorities, implementation, and support needs.[145] Thus, the Paris Agreement encouraged States Parties to 'strengthen their cooperation on enhancing action on adaptation' by adopting similar approaches as enshrined in the Cancun Agreements.[146] It further underscores the role of UN-specialised bodies and agencies in adaptation action.[147]

Through international cooperation and support, countries in the Middle East and North Africa (MENA) region have been receiving financial and technical support from international organisations to enhance climate adaptation efforts. Specifically, the GCF has been providing financial support to countries such as Morocco, Tunisia, and Egypt for the development of their NAPs.[148] International and regional organisations such as the United Nations Development Programme (UNDP) have been offering technical support through capacity-building programmes for countries to strengthen their institutional frameworks and develop the skills needed to address climate change impacts while facilitating knowledge-sharing platforms for countries to share best practices and lessons learned in climate adaptation and resilience.[149] The GCF has been providing financial support to Morocco, Tunisia, and Egypt to develop their national adaptation plans since 2015 when the GCF readiness programme was expanded to Africa and the Middle East region.[150] For Morocco, the GCF-funded project to support the development of its national adaptation plan started in 2021 with a focus on strengthening the institutional framework for adaptation planning, formulating adaptation plans, and developing financing strategies.[151]

Similarly, in Egypt, the GCF has been supporting the development of the national adaptation plan since 2015 with a focus on enhancing climate change adaptation in the North Coast and Nile Delta regions.[152] These forms of support are critical in enhancing the climate resilience of MENA countries. At the bilateral level, developed countries such as the United States through the United States Agency for International Development (USAID) have provided funding and technical assistance to support climate change adaptation efforts in countries like Jordan, Lebanon, and Morocco.[153] In Jordan, USAID has funded several climate change adaptation programmes including the Climate Change Adaptation Programme. The programme focused on technology transfer, specifically the use of non-conventional water resources, reuse of wastewater, rainwater harvesting, and permaculture. The bilateral support is through various channels, including direct funding and technical assistance agreements between the developed countries and developing countries in the MENA region.

Similarly, there are various climate change adaptation programmes being implemented in West Africa to address drought and flooding through international assistance and support. For instance, the World Meteorological Organisation (WMO) is developing early warning systems for floods and droughts in the Volta Basin region, covering an area of roughly 400,000 km^2, including Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali, and Togo.[154] The total project cost is 7,920,000 USD from the Adaptation Fund. This project supports the development of flood and drought forecasting and early warning systems, risk maps, and capacity-building initiatives to improve existing flood and drought management strategies and plans for the six countries in the Volta Basin region.[155] Since 2019, the project has started developing VOLTALARM, an early warning system for floods and droughts in the region that uses global observational and forecasting products like the Global Flood Awareness System and data from the likes of the National Oceanic and Atmospheric Administration and the Japan Aerospace Exploration Agency.[156] These programmes are crucial in enhancing the resilience of West African communities to climate change impacts, particularly drought and flooding. International organisations, such as the WMO and the Adaptation Fund are providing financial and technical support to these initiatives through the international climate change architecture.

However, a significant financial gap still remains. According to the 2023 Adaptation Gap Report, poor nations' adaptation expenditures this decade are expected to range between US$215–387 billion annually.[157] Compared to the prior Adaptation Gap Report's estimate, this is a substantial increase. This is due to two factors. First, adaptation costs are projected to range from 130 to 415 billion USD annually this decade and in the ensuing decades, with the expenses expected to increase until 2050.[158] Second, an extrapolation to all developing countries based on an analysis of the needs expressed in their NDCs and NAPs places the estimated annual needs for adaptation finance at 387 billion USD for 2021–2030, with a range of 101–975 billion USD.[159] These, however, underpin the rationale for international support for climate change adaptation. There are, nevertheless, no concrete targets established for national adaptation efforts, nor are there enforceable commitments to provide adaptation assistance to developing countries.

3.6 THE STATUS OF CLIMATE CHANGE ADAPTATION OBLIGATIONS UNDER INTERNATIONAL LAW

Based on the principles discussed above, State parties can influence international negotiations and rule-making by incorporating ideas, ambitions, a normative

framework, or a specific definition to their advantage. The principles are intertwined and connected in different ways, as evidenced by the analysis. Finding their established connections is quite challenging as none of them have clear definitions and are subject to potentially controversial moral evaluations. More importantly, these principles have functional significance in clarifying or interpreting States' obligations relating to climate change adaptation under international climate law. The UNFCCC incorporates specific provisions on climate change adaptation. Article 2 asserts that mitigation efforts must be sufficient "to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."[160] More generally, the States Parties to the UNFCCC are compelled to engage in actions that enhance adaptation to climate change, irrespective of their developmental status or their GHG emission levels. As a result, all parties are mandated to "formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing ... measures to facilitate adequate adaptation to climate change."[161]

Furthermore, all parties are anticipated to "cooperate in preparing for adaptation to the impacts of climate change, by developing and elaborating appropriate and integrated plans for coastal zone management, water resources and agriculture, and for the protection and rehabilitation of areas, particularly in Africa, affected by drought and desertification, as well as floods."[162] In the end, all parties are further required to "take climate change considerations into account, to the extent feasible, in their relevant social, economic and environmental policies and actions."[163] Although all states are obligated to implement adaptation measures, some may lack the necessary resources to carry out the required actions. Pursuant to Article 4.4, Annex II parties "shall ... assist the developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting costs of adaptation to those adverse effects."[164] This provision represents a nuanced acknowledgement by developed country parties of their obligation to contribute to climate change mitigation. Discussions surrounding the implementation of these provisions resulted in the creation of a work programme focused on the least developed states and the development of National Adaptation Programmes of Action, which are to be supported by a fund specifically allocated for least developed countries.[165]

In 2007, the Bali Action Plan initiated a thorough process aimed at formulating a successor to the Kyoto Protocol.[166] While there was a heightened focus on climate change mitigation, this framework delineates the most robust provisions regarding adaptation to date.[167] The parties concurred to issue a call for "enhanced action on adaptation," which should encompass five integral components:

> (i) International cooperation to support urgent implementation of adaptation actions, including through vulnerability assessments, prioritization of actions, financial needs assessments, capacity building and response strategies, integration of adaptation actions into sectoral and national planning, specific projects and programmes, means to incentivize the implementation of adaptation actions, and other ways to enable climate-resilient development and reduce vulnerability of all Parties...; (ii) Risk management and risk reduction strategies...; (iii) Disaster reduction strategies and means to address loss and damage associated with climate change impacts in developing countries that are particularly vulnerable to the adverse effects of climate change; (iv) Economic diversification to build resilience; (v) Ways to strengthen the catalytic role of the Convention in encouraging multilateral bodies, the public and private sectors and civil society, building on synergies among activities and processes, as a means to support adaptation in a coherent and integrated manner.[168]

The Bali Action Plan, by means of subsequent negotiations facilitated by the Ad Hoc Working Group on Long-Term Cooperative Action established under the Convention, gave rise to the adoption of the Cancún Agreements in the year 2010. The Cancún Agreements contained the "shared vision for long-term cooperative action" and the "enhanced action on adaptation" which indicated the increasing importance of adaptation under the UNFCCC regime. The Cancún Adaptation Framework encouraged countries to follow a particular course of action, including "planning, prioritising and implementing adaptation actions";[169] assessing impacts, vulnerabilities and adaptation needs;[170] "building resilience ... including through economic diversification";[171] and "enhancing climate change related disaster risk reduction strategies".[172] An Adaptation Committee was set up "to promote the implementation of enhanced action on adaptation in a coherent manner under the Convention"[173] through support and guidance, information-sharing and advocacy. There are also complementary provisions on financial support, technology and capacity building.[174]

The Paris Agreement endorsed the approach of the Bali Action Plan and the Cancún Agreements recognising adaptation and mitigation officially on the same level. Article 2(1) underscored "increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten

food production."[175] In particular, Article 7 "establishes the global goal on adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change."[176] It further emphasises "the importance of support for and international cooperation on adaptation efforts."[177] Among other things, States Parties are encouraged to "submit and update periodically an adaptation communication."[178] Under Article 3 of the Agreement, all parties "are to undertake and communicate" action on climate change adaptation, along with mitigation and other aspects of climate action, "as nationally determined contributions to the global response to climate change."[179]

Thus, the Paris Agreement operationalises capacity-building and financial support by translating them into concrete legal rules as it links the global long-term adaptation goals articulated in Article 7(1) and the Intended Nationally Determined Contributions (INDCs).[180] The INDCs consequently provide a foundation for the Agreement by contextualising and clarifying the adaptation goals, outlining the specific adaptation initiatives that states are prepared to implement. By endorsing a decentralised, country-driven approach to determine adaptation needs and priorities, the INDCs promote commitments to adaptation that are attuned to local contexts and politically viable.[181] These commitments are codified in Article 7, which mandates all Parties to undertake evaluations of impacts and vulnerabilities, formulate national adaptation strategies, identify nationally prioritised actions, and implement comprehensive monitoring and evaluation of these initiatives. For developed country Parties, Article 9 provides additional obligations relating to the mobilisation of enhanced climate financing to facilitate adaptation and mitigation efforts, coupled with a compulsory biennial reporting requirement to track the progress of resource commitments.[182] The institutionalisation of adaptation commitments through the INDCs and the Agreement thus constitutes a significant advancement in enhancing the probability of credible commitments from Parties to 'engage in adaptation planning processes and the implementation of actions.'[183]

4 CONCLUSION

Climate change adaptation and its relevant principles and obligations under international climate law have evolved into important guidelines within the UNFCCC framework. The article analyses the international framework for climate change adaptation, focusing on the UNFCCC, the Paris Agreement, and other relevant mechanisms. The findings show that the emerging body of international climate law relating to adaptation uses equity-based principles such as CBDRRC and international cooperation. It also recognises the unique vulnerabilities of developing States and populations in climate change adaptation as it is informed by scientific evidence that foregrounds the measurable impacts of climate change and the need for socio-technical solutions. The analysis further revealed that the principles and norms within the UNFCCC and the Paris Agreement are intentionally open-ended and unclear. In particular, the absence of legal precedent to explain the precise interpretation and application of the CBDRRC and international cooperation in the context of climate change adaptation adds to the uncertainty surrounding the application of these principles. The article argues that the CBDRRC and international cooperation and support should be the foundation of the international framework on climate change adaptation due to their equity-based approach.

Consequently, States Parties to the UNFCCC and the Paris Agreement should determine how to interpret and put into practice the principles generally and the CBDRRC specifically to operationalise them. The article also identifies core obligations related to adaptation, including the development and implementation of NAPs, submission of adaptation communications, and promoting climate-resilient development. It further observes that many provisions on adaptation in international climate law are aspirational rather than legally binding, which raises questions about the actual obligations imposed on states. The CBDRRC, like other treaty texts and principles, is subject to change based on the practice of its Parties. One of the major weaknesses of international climate law is the lack of enforcement mechanisms within the UNFCCC and Paris Agreement to ensure compliance of both developed and developing countries in both mitigation and adaptation efforts. This further weakens the already weak framing of adaptation provisions in the UNFCCC and the Paris Agreement.

Moreover, States Parties to the UNFCCC and the Paris Agreement should strengthen international cooperation and support to facilitate cooperation among countries to share knowledge, expertise, and resources to support climate change adaptation efforts in vulnerable countries. Technology and knowledge transfer are key obligations of developed countries toward developing and least developed countries; thus, international climate law should practically facilitate the transfer of climate adaptation and resilience technologies such as climate-resilient agriculture, water management, and disaster risk reduction to vulnerable countries to enable them to adapt to the impacts of climate change. In addition to this, there should be international mechanisms to operationalise the development and dissemination of climate information and early warning systems to enable vulnerable countries to prepare for and respond to climate-related disasters such as cyclones, typhoons, hurricanes, drought and flooding. Developed countries should also leverage international cooperation and support to foster the development of climate-resilient infrastructure such as

sea walls, levees, and green roofs in vulnerable coastal developing countries and small island developing countries to protect vulnerable communities and populations from the impacts of climate change. Additionally, international climate law should strongly recognise and promote climate justice and human rights in the context of climate adaptation, including the rights of vulnerable populations.

The COPs, through future decisions, should develop specific and binding commitments on climate change adaptation, including clear targets, timelines, and financing mechanisms. Developing countries, least developed countries and small island developing countries may be bold in the near future to push for a negotiation for a new adaptation protocol under the UNFCCC that focuses specifically on adaptation, with clear obligations and guidelines for countries. By addressing these gaps, international climate law can play a critical role in supporting climate change adaptation efforts, particularly for vulnerable countries and populations. Based on the scope and findings of the article, further study is needed to explore how international climate law can effectively promote adaptation-based technology transfer and cooperation, including the development of climate-resilient technologies and best practices sharing. Additionally, there is a mounting need to interrogate how an international framework on climate adaptation can address climate change displacement and migration. Finally, there is a need for future studies to focus on developing metrics and indicators to measure progress on international climate adaptation efforts, including the development of climate-resilient infrastructure and the promotion of climate-resilient agriculture in developing and least developed countries.

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COMPETING INTERESTS

The author has no competing interests to declare.

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TO CITE THIS ARTICLE:
Michael Addaney, 'International Climate Law: Principles and Obligations for Adaptation' (2025) 40(1) *Utrecht Journal of International and European Law* pp. 23–42. DOI: https://doi.org/10.5334/ujiel.653

Submitted: 05 September 2024 **Accepted:** 24 June 2025 **Published:** 21 August 2025